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A note on the egg capsule of *Nodilittorina unifasciata* from eastern Australia.

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Introduction

This is the first published description of the planktonic egg capsule of *Nodilittorina unifasciata* (Gray, 1826), a common littorinid snail living high on rocky shores of southern Australia from northern New South Wales to southwestern Western Australia. It is a dominant animal on many shores and has been the subject of many biological and ecological studies (– as *Littorina unifasciata*: Branch & Branch, 1981; Chen & Richardson, 1987; Underwood, 1974; Underwood & Chapman, 1989; Wells, 1984). The transfer of this species to *Nodilittorina* was proposed by Bandel & Kadolsky (1982), and supported by Reid (1989). Our understanding of the life history of *N. unifasciata,* is based on histological studies of the gonad (Underwood, 1974) and structure of the pallial oviduct (Reid, 1989). Murray (in an unpublished letter in Pilkington, 1971) reports that both *N. unifasciata* and *N. praetermissa* (May, 1908) liberate egg capsules (presumably planktonic) with the veliger stage already well-developed, and these were also studied by Tin Nwe (1974). The planktonic egg capsules of *N. antipoda* (Philippi, 1847) (as *Melarapha oliveri* Finlay, 1930), a supposed subspecies of *N. unifasciata* from New Zealand, and another New Zealand species, *N. cincta* (Quoy & Gaimard, 1833), have been described (Pilkington, 1971).

Many studies have shown that the ability to identify accurately littorinid egg capsules from inshore plankton samples, or high tidal pools, is a valuable tool in studying the life history and ecology of these animals (Habe, 1956; Kojima, 1957a,b, 1958; Borkowski, 1971; Pilkington, 1971; Ohgaki, 1981). Reid (1989) has discussed the value of capsule morphology in understanding the phylogeny and taxonomy of the Littorinidae.

Methods & Results

Snails ranging in shell height from 15–19mm were collected from supra–littoral aggregations at Harbord, Sydney, NSW (at low tide, 6 October 1995) and placed in groups of 12–15 in glass jars half filled with sea water, at 4pm the same day. The jars were left until 9am, 9 October, when four out of six jars contained a few free swimming veligers and up to 10–12 egg capsules (Figs 1, 2c). The seawater was changed daily and a similar number of eggs were laid each day, until observations ceased 10 days later. In a few cases 3–4 capsules adhered together in a string for a few hours after hatching but separated with moderate water movement. No attempt was made to time or study development, but eggs were laid at the single cell stage and within 12 hours were fully developed veligers, hatching within 18 hours. The ambient room temperature was maintained between 22–24°C. The observation by Murray (in Pilkington, 1971) that capsules were laid with fully developed veligers was not confirmed.

Egg capsules appear disc, or dome-shaped ('cupola' type of Reid, 1989), and almost completely transparent. There is a prominent central dome on the convex face of the capsule, and there is a central swelling on the concave face to accommodate the egg. During hatching, the veliger breaks free in this

Figure 1. Pelagic egg capsules of *Nodilittorina unifasciata* laid by snails collected at Harbord, Sydney, October 1995. Capsule diameter 240 µm. Photo: G.Avern.

region of the concave face. The convex face of the capsule is perhaps best described as a dome, with a somewhat roughened surface, surrounded by a wide cylindrical skirt. There is a distinct median ridge around the broad outer edge of the skirt.

Because of the extreme transparency of the capsule, external sculpture is only visible by manipulating the direction of incident light falling on the capsule. There is clearly a median ridge on the outer half ('skirt') of the capsule. In some angles of light, under the microscope, it is possible to consider that there is a 'thickening', or rounded ridge, at both the outer and inner edges of the capsule skirt. The widest diameter of the capsule is 240 µm, and the egg diameter approximately 100 µm.

Discussion

Rosewater (1970) suggested that the Australian *N. unifasciata* and a common, similarly coloured New Zealand species, *N. antipoda* (Philippi) (= *Melaraphe oliveri* Finlay), were subspecies. The latter species is found throughout New Zealand, has a characteristic blue and white shell, and is seldom greater than 1cm in height. A comparison of the reported morphology of the planktonic egg-capsules of *N. antipoda*, and a second New Zealand species, *Nodilittorina cincta* (Pilkington, 1971), with the egg-capsules of *N. unifasciata* from Australia, suggests that either the two 'subspecies' are distinct species or that Pilkington (1971) misidentified the capsules she described.

The egg capsule of *N. cincta*, as described by Pilkington (1971)(Fig. 2A), is quite similar to that of *N. unifasciata*, while the egg capsule of *N. antipoda* (as *M. oliveri*) (the supposed subspecies of *N. unifasciata*), is quite different (Fig. 2B). In *N. cincta*, the egg capsule has a broad outer skirt with a distinct ridge, surrounding a central dome-shaped region, similar to *N. unifasciata*. Both are very similar in diameter. In comparison, the egg capsule of *N. antipoda* is much more regularly dome-shaped. Veliger larvae hatch from the capsules of both *N. cincta* and *N. antipoda* 3–4 days after laying (Pilkington, 1971), while I have observed hatching in *N. unifasciata* within 18 hours.

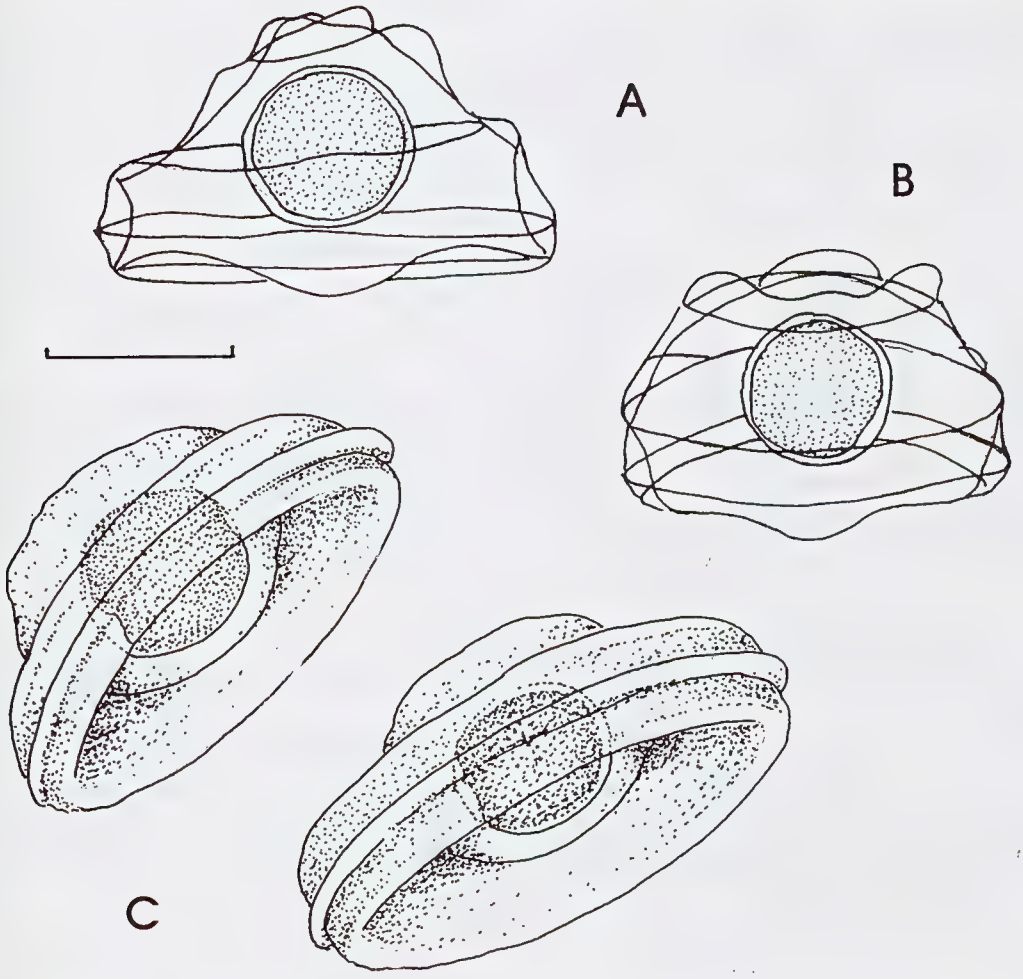

Figure 2. Pelagic egg capsules of *Nodilittorina*. A, *N. cincta*., B, *N. antipoda*., C, *N. unifasciata*. (A,B, after Pilkington, 1971). Scale = 100 µm.

The similarity between the capsules of *N. unifasciata* and *N. cincta*, and their difference in shape to the capsule of *N. antipoda* is puzzling. One would expect that the egg capsules of the two supposed subspecies of *N. unifasciata* would be similar in shape, and different from a second species. Certainly the studies of Japanese species (cited above), and of Caribbean species (Borkowski, 1971) would suggest that egg capsule morphology is species specific (but see Reid, 1986 for contrary view). On the basis of these observations it would seem necessary to restudy the egg capsules of the New Zealand species. The close similarity in egg capsule morphology between the Australian *N. unifasciata* and the New Zealand *N. cincta* suggests that either a misidentification has occurred, or if Pilkington's observations are confirmed, that the two 'subspecies' of *N. unifasciata* are distinct species. This would support Reid's listing (1989) of both *N. unifasciata* and *N. antipoda* as full species (without discussion but on anatomical grounds – D.Reid; *pers.com*).

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